

## **Metabolomics**

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Metabolomics is the study of changes in the population of small molecules or metabolomes, in cells, tissues and biological fluids such as serum and urine. Metabolomics, using  $^1\text{H}$ -NMR, has gained prominence and been embraced by the pharmaceutical industry as a means to determine the potential toxic effects of drugs. For example, a chemical is administered to rodents and urine and serum examined for the presence of metabolites that reflect organ-specific toxicities. Mass spectrometry coupled with liquid or gas chromatography, is gaining increased use for metabolomics due to lower costs and more widespread equipment availability as compared to NMR. In particular, ultra performance liquid chromatography coupled with time-of-flight mass spectrometry (UPLC- TOFMS) yields high-resolution separation and exact mass determination of compounds in biological materials. The UPLC-TOFMS data are deconvoluted by various multivariate data analysis software such as principal components analysis (PCA) and Random Forest to find differences between samples. To study xenobiotic metabolism and toxicity, compounds are administered to mice and serum and urine examined by PCA for the presence of the parent compound and its metabolites that are not found in untreated mice. Metabolites derived from the drug as well as endogenous metabolites that reflect the drug's biological activity or toxicity can be resolved. Metabolomics is also being used to search for biomarkers for various diseases that involve chemical insults such as cancer and metabolic diseases. This can be accomplished by use of cancer bioassays in mice and directly by studying human cancer patients and controls. These biomarkers can be developed for use in early cancer detection and for determining the efficacy/toxicity of cancer therapy.